Indian Institute of Technology Guwahati

ME 101: Engineering Mechanics (2016-2017, Sem II)

Tutorial 10 (17.04.2017) (Div 1 & 4)

Time: 8:00 AM – 8:55 AM **Full Marks**: 40

Q.1 – The 1200-mm slender bar has a mass of 20 kg with mass center at *B* and is released from rest in the position for which θ is essentially zero. Point *B* is confined to move in the smooth vertical guide, while end *A* move in the smooth horizontal guide and compressed the spring as the bar falls. Determine *(a)* the angular velocity of bar as the position $\theta = 30^{o}$ is passed and *(b)* the velocity with which *B* strikes the horizontal surfaces if the stiffness of the spring is 5 kN/m.

Q.2 – The velocity of the 8-kg cylinder is 0.3 m/s at a certain instant. What is its speed *v* after dropping as additional 1.5 m? The mass of the grooved drum is 12 kg, its centroidal radius of the gyration is $\bar{k}$ =210 mm, and the radius of its groove is r_i = 200 mm. The frictional moment at *O* is a constant 3 N-m.

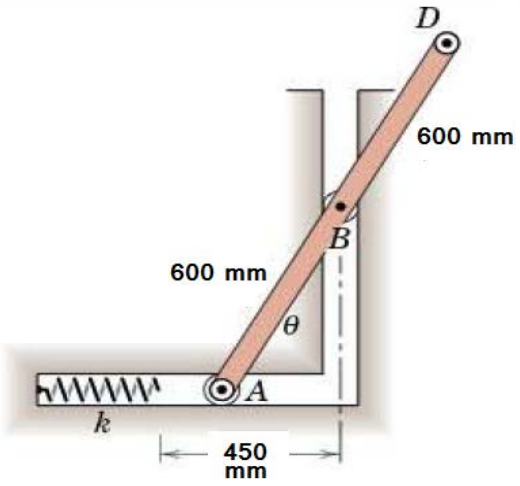

Fig. 1 (Question 1)

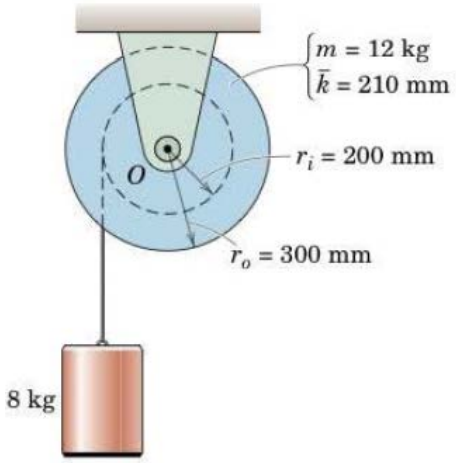

Fig 2. (Question 2)

Q.3- A constant force *F* is applied in the vertical direction to the symmetrical linkage starting from the rest position shown. Determine the angular velocity ω which the links acquire as they reach the position $\theta = 0$. Each link has a mass m_0. The wheel is a solid circular disk of mass *m* and rolls on the horizontal surface without slipping.

Q.4– A slender rod of length *l* is pivoted about a Point *C* located at a distance *b* from its center *G*. It is released from rest in a horizontal position and swings freely. Determine *(a)* the distance *b* for which the angular velocity of the rod as it passes through a vertical position is maximum, *(b)* the corresponding values of its angular velocity and of the reaction at *C*.

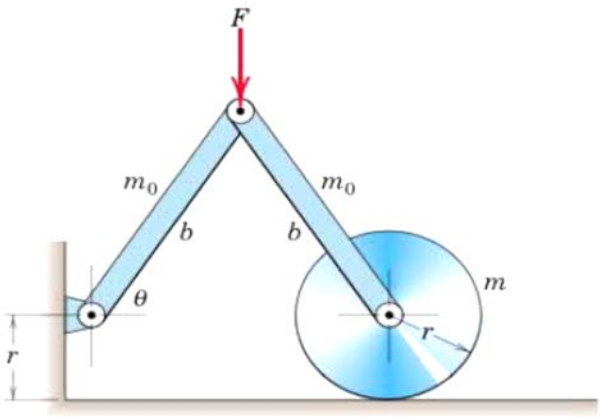

Fig. 3 (Question 3)

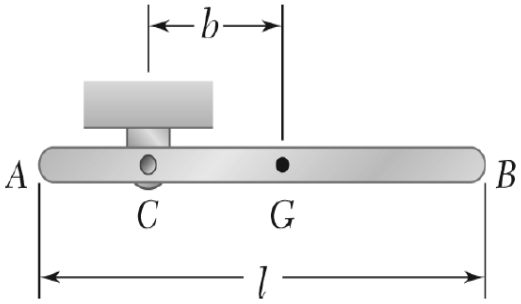

Fig 4. (Question 4)

Q.5 – For the assembly shown, arm *OA* has a mass of 0.8 kg and a radius of gyration about *O* of 140 mm. Gear *B* has a mass of 0.9 kg and may be treated as a solid circular disk. Gear *C* is fixed in the vertical plane and cannot rotate. If a constant moment M = 4 N. m is applied to arm *OA*, initially at rest in the horizontal position shown, calculate the velocity *v* of point *A* as it reaches the top A'.

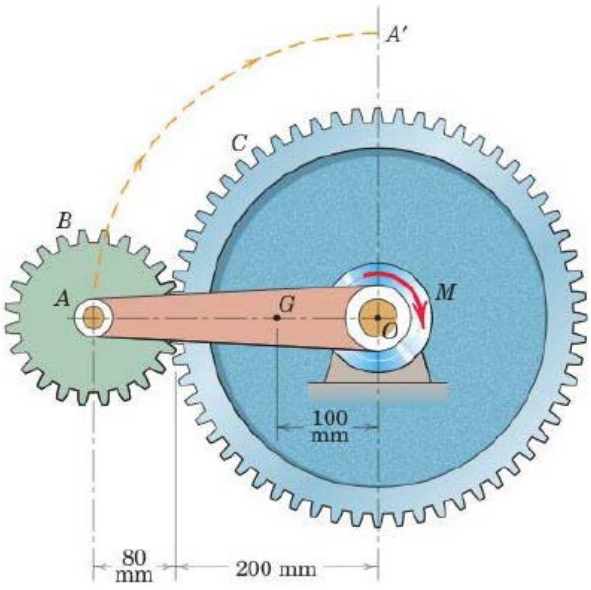

Fig 5. (Question 5)